

The Kessler Project

On September 29, 2011, China launched its first space laboratory, the Tiangong-1. This momentous venture represented China's first step in creating a human presence in space and was supposed to have deorbited in 2013; however, it still orbits Earth in a state of abandonment.

The Tiangong-1's desertion is emblematic of a greater problem threatening the future of space travel: Kessler Syndrome. Donald J. Kessler envisioned a scenario where the increasing amount of objects and debris would continuously collide at an increasing rate, leading the sheer density of objects in orbit to render satellites and other space activities infeasible. Instead of being an example of this scenario, what if the Tiangong-1 became both the first space station with permanent human presence and the hub for a large-scale "space rehabilitation?"

The Tiangong-1 is placed at the heart of the Kessler Station, a space center for the cleaning of the hundreds of thousands of pieces of debris orbiting the Earth at speeds of up to 17,500 mph. Also serving as an interorbital museum, the project repurposes abandoned and soon-to-be outdated landmarks such as the Hubble Space Telescope, Vanguard 1, the ISS, and the aforementioned Tiangong-1, to be visited by guests as part of an all-day space adventure. Since these objects do not experience the decay of Earth-bound artifacts, they should be treasured as the most intact representations of our time.

Team Member	Major/ Minor	Contribution
Participant #1	Mechanical Engineer	Team Leader, Mechanical Design, Solidworks Modeler, Screenwriter
Participant #2	Mechanical Engineer	Circuit Design, Model Design, Video Producer/Editor, Solidworks Modeler
Participant #3	Computer Science/Fine Arts	Graphic Design, Character Design, Screenwriter, 3D Modeler
Participant #4	Digital Media Design/Fine Arts	3D Modeler, Texture Creator, Renderer, Graphic Designer

Story behind the design

Alerted by the dangerous implications of Kessler Syndrome, a group of scientists and engineers convened in Southern California and assembled a group of four robotic companions to aid them in their research. This group, named the Kessler Crew, served as the catalyst for the Kessler Project, an initiative consisting of multiple space stations tracked by a single earth station. Their goals are to raise public awareness of this largely unknown problem, research new debris-mitigation methods of satellite design, and remove the space debris from orbit.

Amidst the clouds of space junk orbiting Earth, the Kessler Crew noticed a multitude of abandoned landmarks. Inspired by this, the Crew built the Kessler Station around the Tiangong-1. The space laboratory represents the sanctity of such achievements and the importance of cleaning space to continue pushing humanity further. The Station serves as a large-scale space timeline spiraling through space. On one end, a set of ships and pods allowing guests to visit the momentous innovations of the past orbiting Earth. On the other, an observatory for guests to take in the vastness of our future in outer space as they experience zero gravity within the transparent walls of the station. Guided by their creators' goals, the robots of the Kessler Crew grew in number and now serve as the Project's cosmic caretakers.

User/ Guest Experience

To begin their journey, guests from all over the world book a seat on the rocket ship either online or at the lobby for a particular day. On the morning of their scheduled launch, these space-inspired guests enter the Tracker Station where they are trained by professionals and given a Mission Command Wristband to enhance their experience within the Kessler Station. After watching the introductory video and passing the safety protocols, guests travel out of the Tracker Station to the Launch Pad via Tracker Pods running along an Ocean Highway System. The Tracker Pods interface directly with the rocket, allowing the guests to relax in their pod for the entirety of the trip.

The journey to the Kessler Space Station lasts thirty minutes. Once they arrive, guests have free-reign to go anywhere they please within the station. Places include a space cafe, an observatory that hosts a variety of games, a helical walkway, and a central axis tunnel. While the Tiangong-1 sits at the center of the axis, guests can board small tour ships to visit other abandoned or decommissioned space achievements such as the Hubble Space Telescope, Vanguard 1, and the ISS. They can also travel to the Tugger Station to see the cleaning of space debris firsthand, to learn about the effects of Kessler Syndrome, and to receive keepsakes made from space debris.

After a once-in-a-lifetime day in space, guests are treated to a light show featuring the Kessler Crew and a crowd of "NovaLights." Guests can alter the color of individual NovaLights with their wristbands. At the conclusion of the show, guests head back to the rocket to go home.



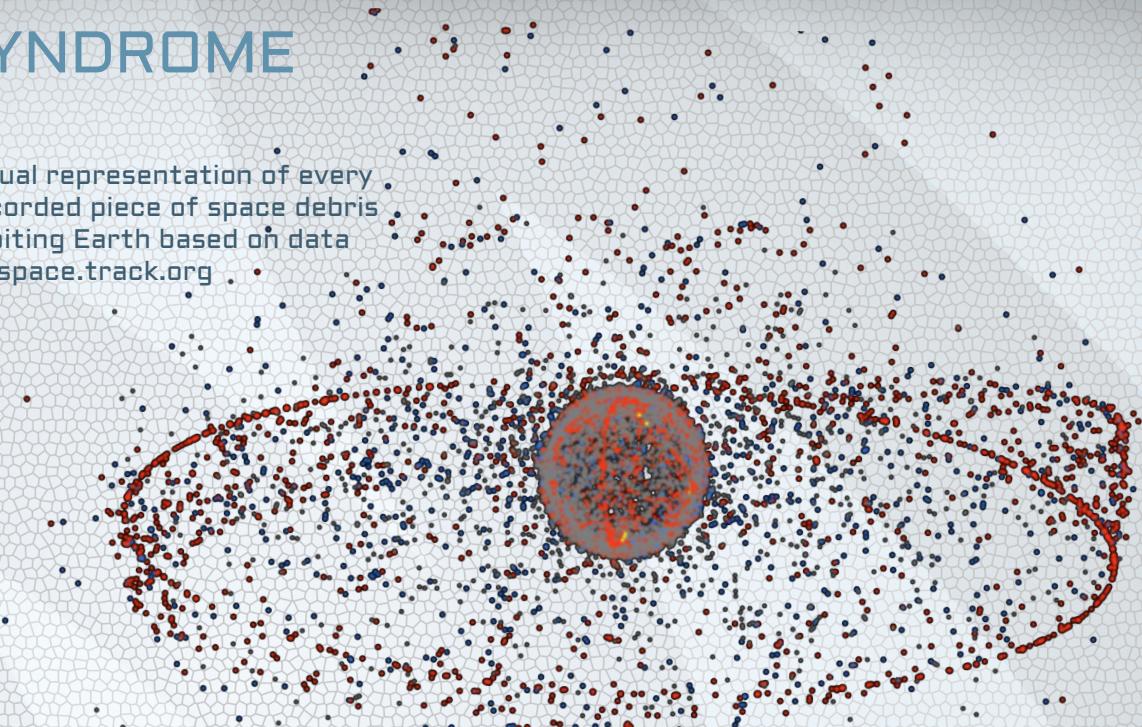
KESSLER SYNDROME

Kessler Syndrome gained recognition in 2009, when the Iridium 33 satellite collided with the defunct Russian Cosmos 2251. This impact directed thousands of pieces of debris at the surrounding satellites used for telecommunication and remote-sensing. From there, the amount of debris surrounding Earth has only increased exponentially.

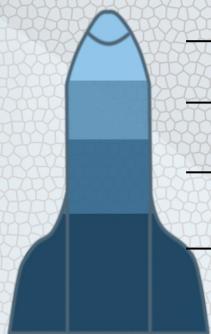
As of 2017, roughly **600,000** individual pieces of space debris currently reside in Low-Earth Orbit.

The Envisat, one of the visitable exhibits, is a large inactive satellite that is in great danger of colliding with debris. If left alone, it would become a major debris contributor for the next 150 years.

Visual representation of every recorded piece of space debris orbiting Earth based on data by space.track.org

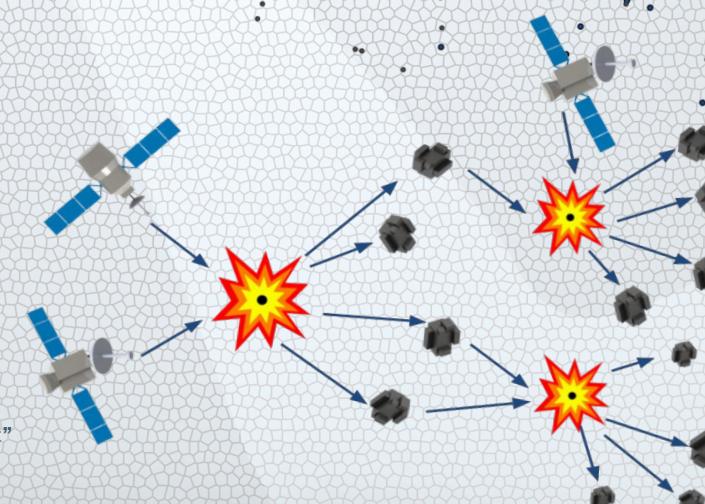


Source of Space Debris by Percentage



- 17% Rocket Bodies
- 19% Mission-related Debris
- 22% Non-functional Spacecraft
- 42% Fragmentation Debris

Data taken from "The Issues and Complexities Surrounding the Future of Long Duration Spaceflight"



The debris caused by a collision between satellites creates a cascading effect that impacts other satellites.





TRACKER CENTER

Located southwest of the Devereux Lagoon, the **Tracker Center** serves as the HQ for the Kessler Project. Here, the staff works to ensure that the guests' transition to outer space is as smooth as possible. They provide the guests with the prerequisite training and admission to the Kessler Station while also offering tours of the facility and resources to conduct research.



TRACKER STATION

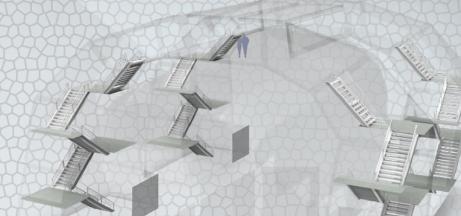
The **Ocean Highway** transports guests from the Tracker Station to the **Launch Pad**, a repurposing of the former Platform Holly oil rig.



The **Sky Walk** enables guests to view the surrounding natural landscape of Santa Barbara.



The **Research Room** houses a suitable workspace for local students of UC, Santa Barbara to conduct research.



The **Tracking Room** ensures that the Tugger, the Kessler, and all exhibits are functioning properly and can send maintenance staff to any station in need.

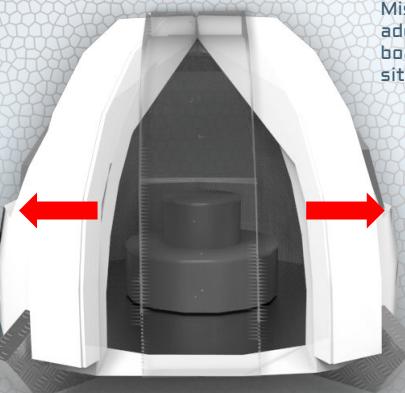


The **Theater Room** screens a film that prepares guests on what to expect on their trip to outer space and the purpose of their mission.

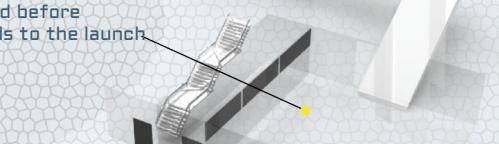


Guests may check in at the front desk of the **Lobby** and obtain any information needed before boarding.

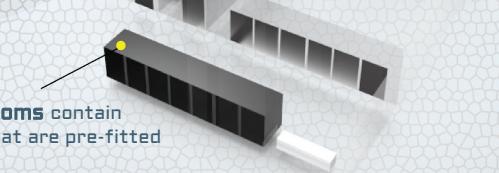
The **Tracker Pod** is a Hubble Observatory-inspired vehicle with doors that slide open.



The **Boarding Room** gives each guest a Mission Command Wristband and any additional training needed before boarding the tracker pods to the launch site.



The **Changing Rooms** contain astronaut suits that are pre-fitted for every guest.



SECOND FLOOR

FIRST FLOOR

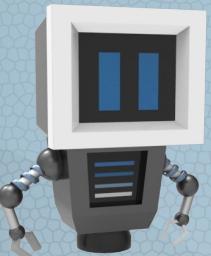
GROUND FLOOR



THE KESSLER CREW

Kess:

The ambitious leader of the Kessler Crew uses his Kess-Arms™ to deorbit space debris. His number one priority is to tackle the problem of Kessler Syndrome hands-on.



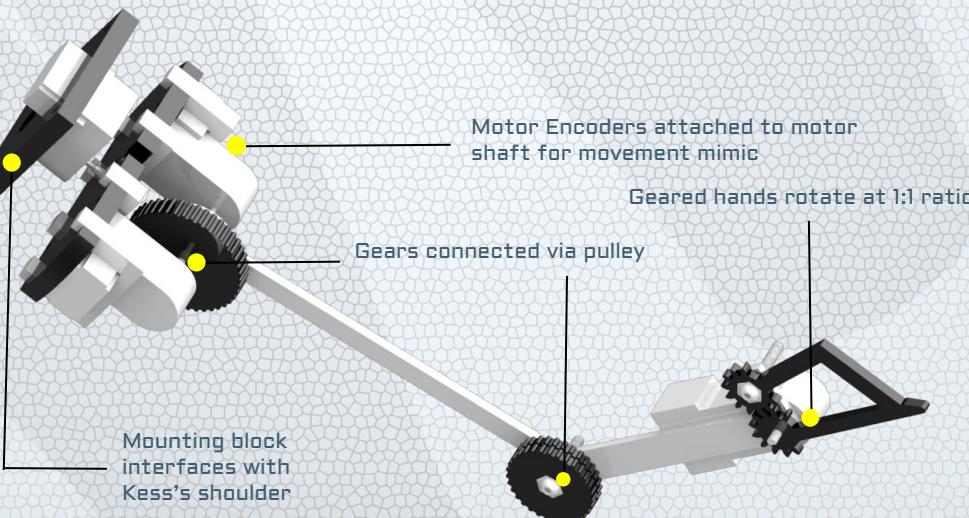
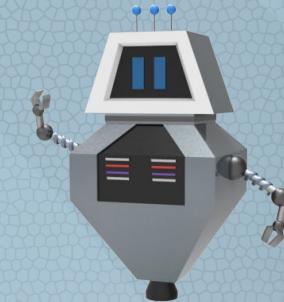
Jolt:

Kess's energetic sister is the youngest member of the Crew. She hosts the events in the observatory and is an excellent guide for kids. Whenever she's excited, the metal "hairs" on her head begin conducting electricity.



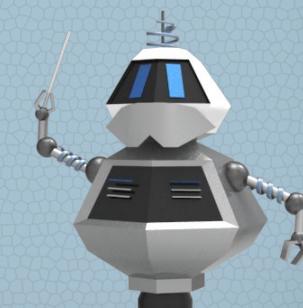
Valent:

Inspired by the first woman astronaut in space, Valentina Tereshkova, Valent is in charge of all transportation. Astute and vigilant, she takes the safety of her passengers very seriously.



Kep:

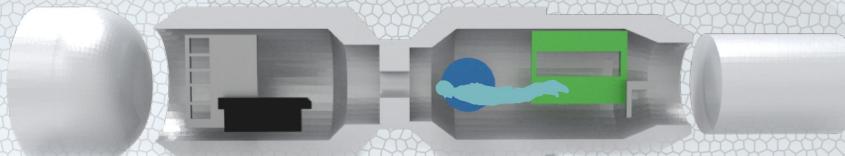
Named after Johannes Kepler who created the laws of planetary motion, Kep is an inquisitive robot who can be a bit of a know-it-all. He loves teaching guests about the exhibits and the implications of space travel.





KESSLER STATION

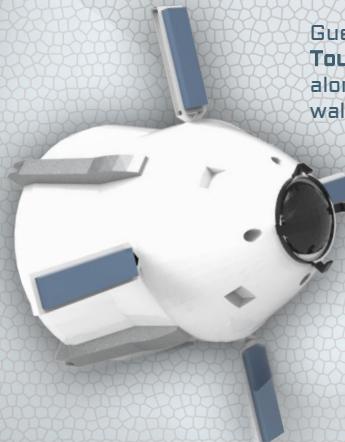
The Kessler Station is the central hub for all of the activity in the project. The helical structure rotates about a central axis of which the Tiangong-1 is centered. Guests disembark on the near side of the structure and can reach the observatory side in one of two ways: propelling through the central axis in zero gravity or walking along the helical structure.



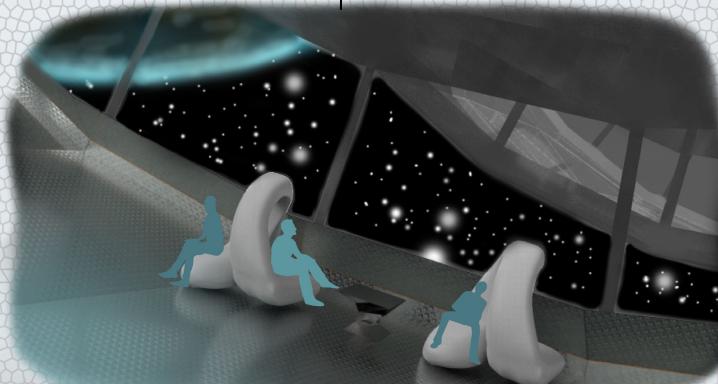
Guests can visit the restored **Tiangong-1** via tunnels from the helix to the center to get a sense of early space travel.



In the **Docking Center**, guests follow signs along the center tunnel to find the tour ship for their desired location.



Guests board the **Tour Ship** and strap in along the edge of the wall.



Jolt hosts events and games in the **Observatory** for the younger guests between long star-gazing sessions. These games include tag, dodgeball, catch, and basketball. Parts of the floor can be raised to create a maze.



The **Spiral Seat** allows guests to enjoy the breathtaking views of outer space along the edge of the helix.



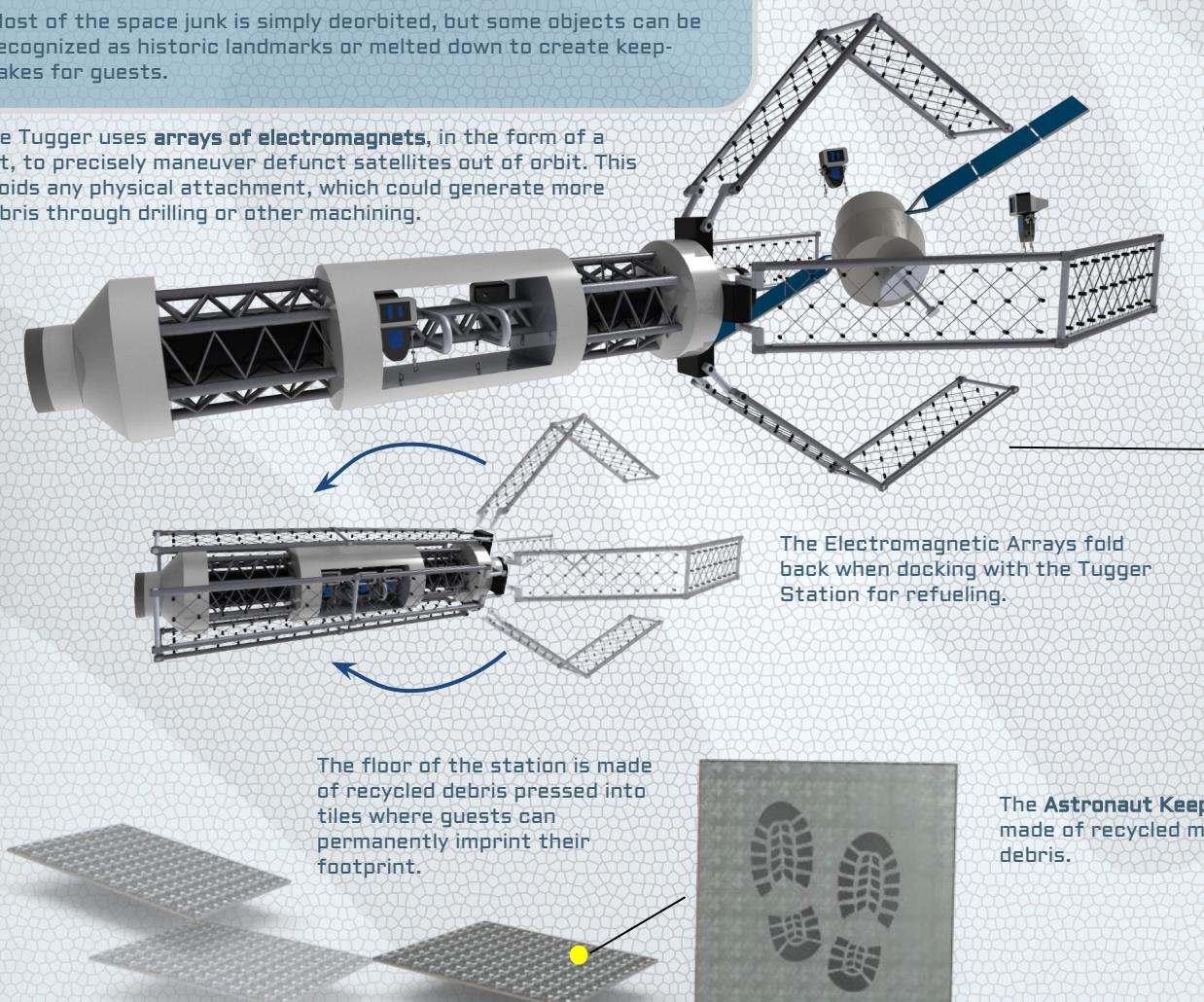


RESTORATION AND PRESERVATION

The **Tugger Station** is where guests can see the project actively cleaning the space debris. A group of Kess Robots, whose arms are controlled remotely by operators on the ground, perform the more delicate parts of the operation.

Most of the space junk is simply deorbited, but some objects can be recognized as historic landmarks or melted down to create keepsakes for guests.

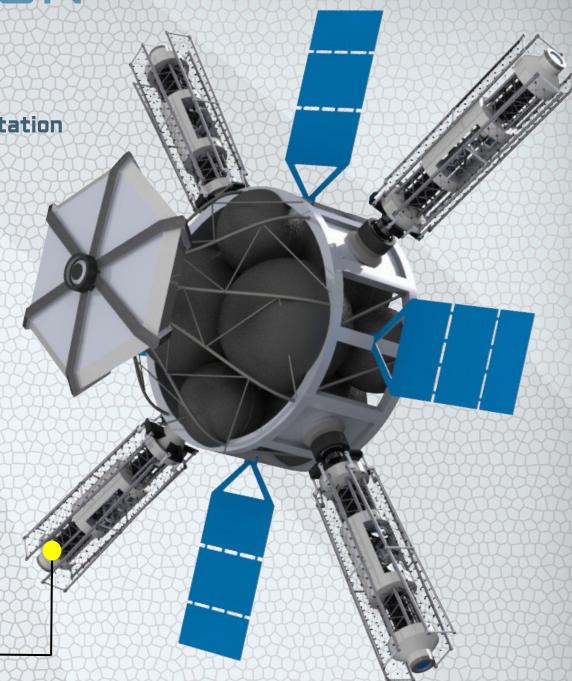
The Tugger uses **arrays of electromagnets**, in the form of a net, to precisely maneuver defunct satellites out of orbit. This avoids any physical attachment, which could generate more debris through drilling or other machining.



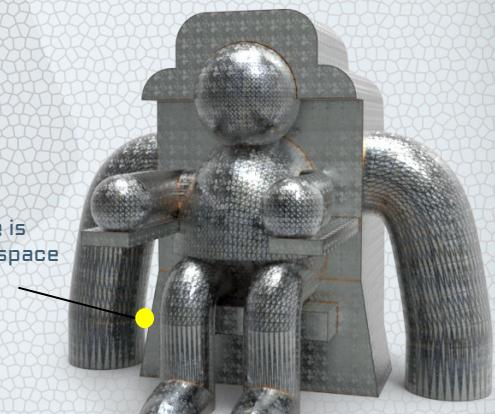
The floor of the station is made of recycled debris pressed into tiles where guests can permanently imprint their footprint.



The **Tugger Station**



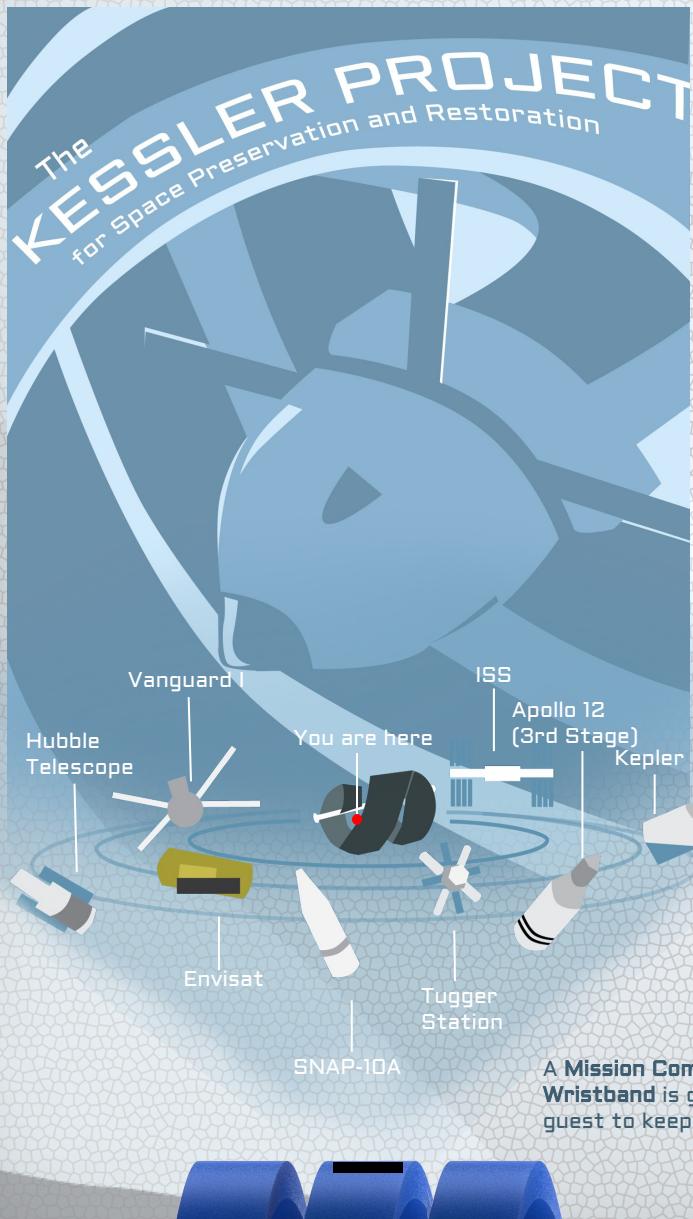
The Electromagnetic Arrays fold back when docking with the Tugger Station for refueling.



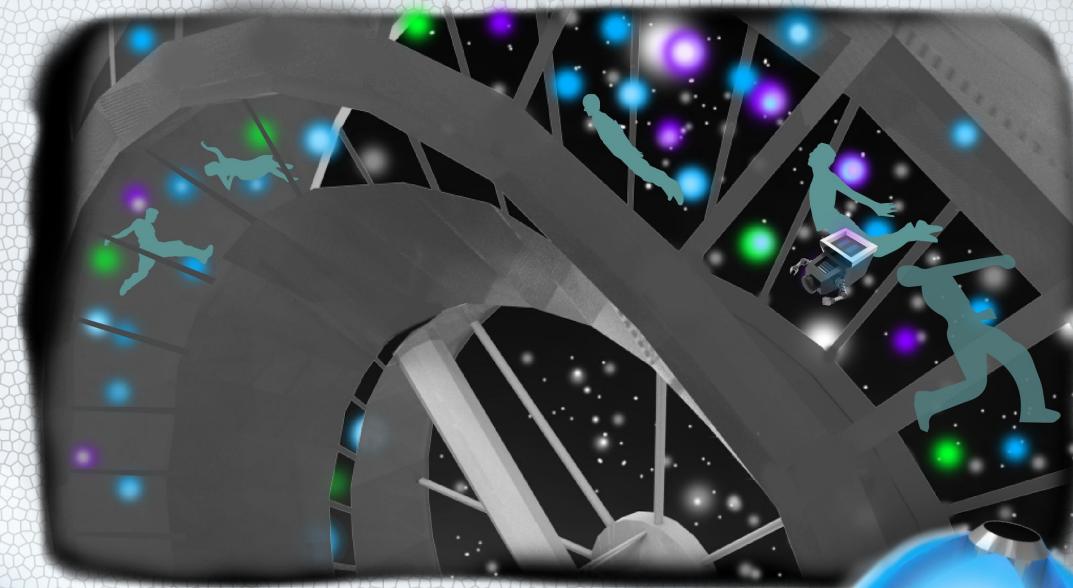
The **Astronaut Keepsake** is made of recycled metal space debris.



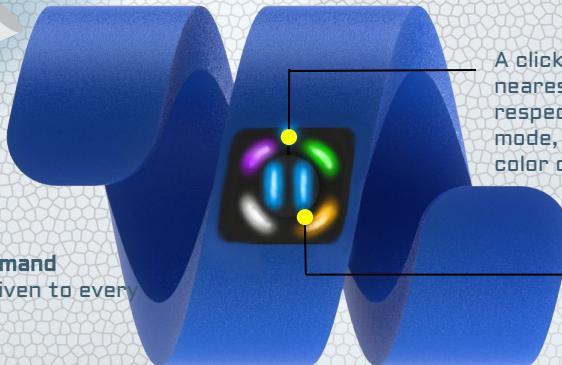
EXHIBITS AND EXPERIENCES



At the end of the day, guests meet with the Kessler Crew in the observatory to enjoy the nighttime light show: **“SuperNova.”**



The star of the show, the **NovaLight™**, utilizes a self-correcting propulsion positioning system to orient itself in relation to other orbs. Crowds of NovaLights configure themselves into various shapes and colors. The outer surfaces amplify light emitted from RGB LED's. The power supply and tank are hidden in the core.



A click of the button contacts the nearest Kessler Crew robot by its respective color. When in NovaLight mode, the button can change the color of the orbs.

To view a hologram of the exhibit map, hold down the button with two fingers.

